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NASA TECH BRIEF

Goddard Space Flight Center

Computer Program for Spacecraft-Booster Separation Spring Selection, Set Composition, and Location Determination

The problem:

The selection, grouping, and location of separation springs of the correct mechanical properties is a critical mechanical engineering problem. Properly selected, these springs provide the combined reaction for a stable spacecraft-booster separation to enable spacecraft to achieve proper orbit attitude in the Nimbus and ERTS (Earth Resources Technology Satellite) Spacecraft Programs.

The solution:

A computer program was developed which combines all calculation and determination requirements into one comprehensible technique. The program automatically performs the selection of separation springs, the composition of spring sets, and the correct spring location with improved accuracy and reliability.

How it's done:

The computer program performs the following:

a. It accepts raw force/deflection data from a calibration procedure, computes a spring constant for each spring, and ranks the springs in the order of increasing spring rate.

b. From weight, center of gravity, and mass data for both spacecraft and booster, the program selects the ten best combinations of spring sets (four springs per set) from as many as 60 available springs. It then determines the correct location of each respective spring within the spacecraft to achieve a stable separation.

c. Upon the selection of any of the ten best sets of four springs each, the program prints out the values of preload, the deflection setting, and the exact gap to be expected between spacecraft and booster at each spring location before the final mating of the spacecraft to the booster.

Notes:

1. This computer program has been successfully employed in both the Nimbus and ERTS Spacecraft Programs. The technique has eliminated manual engineering calculations and has provided a fast, accurate, and improved means of performing spring selection and location determination.
2. This method is applicable to any two-body separation problem involving a selected spring separation system.
3. The computer program is written in FORTRAN IV for use on the Honeywell Model 635 (formerly GE 635) computer, and it can be converted for use on the IBM-7094 computer or any computer with an equivalent FORTRAN IV capability.
4. Inquiries concerning this program should be directed to:

   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: GSC-11616

Source: Space Division of
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